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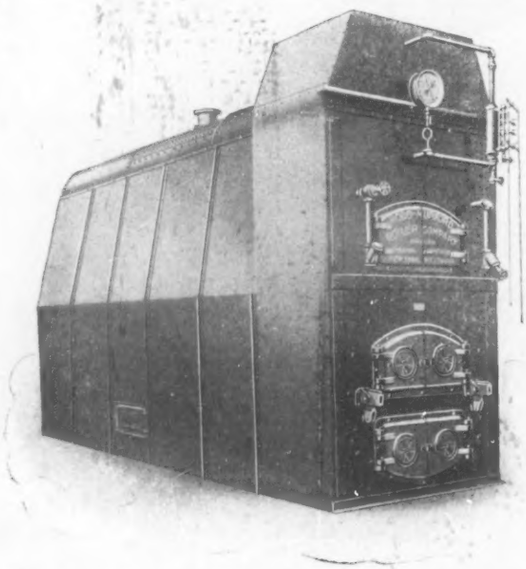

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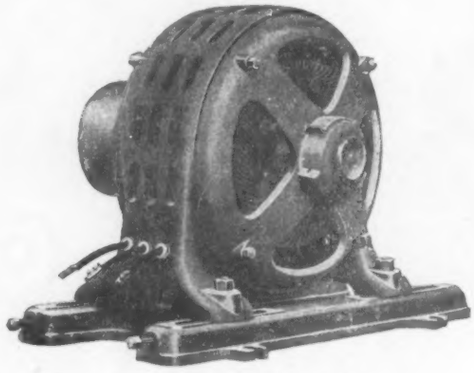

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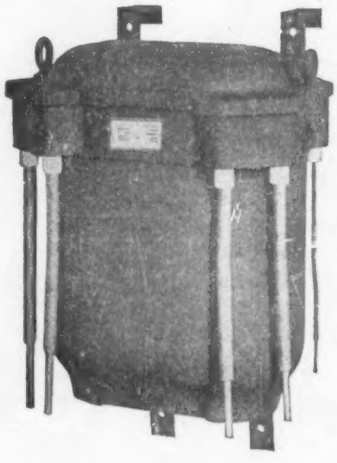

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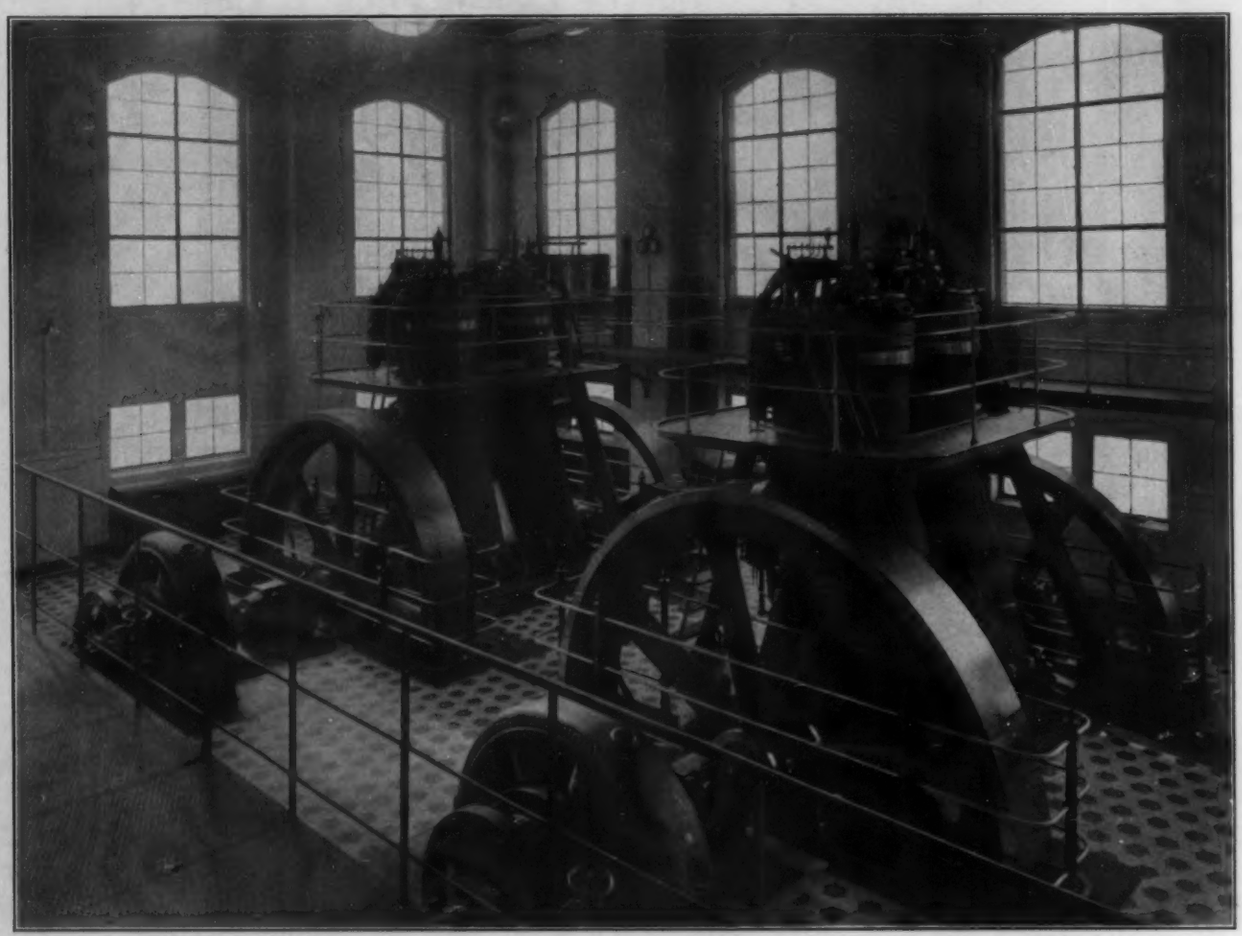
A DIESEL ENGINE POWER STATION

By J. B. VAN BRUSSEL

In the case of electricity works of a moderate size, the Diesel oil engine is now a keen competitor of the small steam engine or suction gas engine. One of its greatest advantages is the short time in which the Diesel engine can be started. Further, the machine has a high heat efficiency, 35 per cent being claimed, and the floor space it occupies is said to be smaller than that taken by any other internal combustion engine. In addition we may say that such stations having no chimney, there is no trouble of smoke, and the stations always can be built resembling ordinary dwelling houses. These were the considerations that decided the authorities of Friedenau, a suburb of Berlin, to select the Diesel engine for their new power station, which we hereafter are describing.



DIESEL OIL ENGINES

The internal arrangements of the building are as follows: In the basement, beneath the office buildings, is a battery room, containing 264 cells, with a capacity of 600 ampere-hours on a two hour discharge rate; in addition to this the basement contains the chief reservoir for the paraffin oil to be consumed in the engine; its capacity is twelve cubic meters. Above the offices are living rooms for the mechanics; above these again are stores for meters, etc., and also four iron reservoirs. Two of these reservoirs have a capacity of two cubic meters each, and contain paraffin oil, which is pumped from the main reservoir in the basement, and flows down through filters to the engine. The other two are each of four cubic meters capacity, and con-

tain the cooling water which is pumped up from the station's own well.

In the engine-room, which adjoins the offices, are two Diesel engine sets, made by the Augsburg Engine Works. Each is a two-cylinder engine, giving a normal output of 250 horse-power at 155 revolutions per minute and 300 horse-power on overload. The stroke is twenty-nine inches, and the cylinder diameter nineteen and three-fourths inches. The two cranks are set at the same angle. Figs. 2 and 3 show the engine respectively in longitudinal and cross-section. It should be mentioned, however, that the drawings do not apply to the actual machines at Friedenau, but represent machines of the same size and design, but with only one flywheel instead of two. There is no cross-head, as the piston is over thirty-nine and one-fourth inches long, and, therefore, renders this unnecessary. Two flywheels, one of which has a diameter of about twelve feet two inches, and weighs about seven tons, and the other about thirteen feet nine inches in diameter, and weighs about fifteen tons, are used to make the turning moment even; and it is stated that the unequality of turning moment does not exceed 1-140. The machines are single acting, and work in accordance with the following cycle:

1. The piston moves downward and draws atmospheric air into the cylinder.

2. The piston moves upwards, and compresses the air, heating it.

3. At the moment that the piston changes its direction, and begins to go downwards again, the liquid fuel is injected, and coming in contact with the hot air, is ignited, expands, and produces the working stroke. The introduction of the fuel is by means of compressed air, the pressure of which must naturally be higher than that within the cylinder, being actually from fifty to sixty-five atmospheres.

4. The piston goes upward again, and drives out the exhausted gas, which completes the cycle.

The cylinder has four valves: the starting valve "V," for letting in the compressed air; the suction valve, "E," for the atmospheric air; the fuel valve, "B," for admitting the liquid fuel into the cylinder; and the exhaust valve for the exhaust gas. All the valves are closed by springs and opened by levers, which are actuated by cams "S." The cams are all placed on a common shaft "H," which is driven from the crankshaft by two wormwheels on a vertical shaft. The levers for the starting and fuel valves are connected together in such a manner that these valves cannot both be opened at the same time. These levers are moved by a handle "G."

The engine is started in the following manner: The engine is first moved over the dead point, by the barring gear, seen in the figures, and then the handle "G" is put over to the starting position. Compressed air from the starting reservoir (which is one of those compressed air tanks shown in Fig. 3, and contains air at fifty atmospheres'

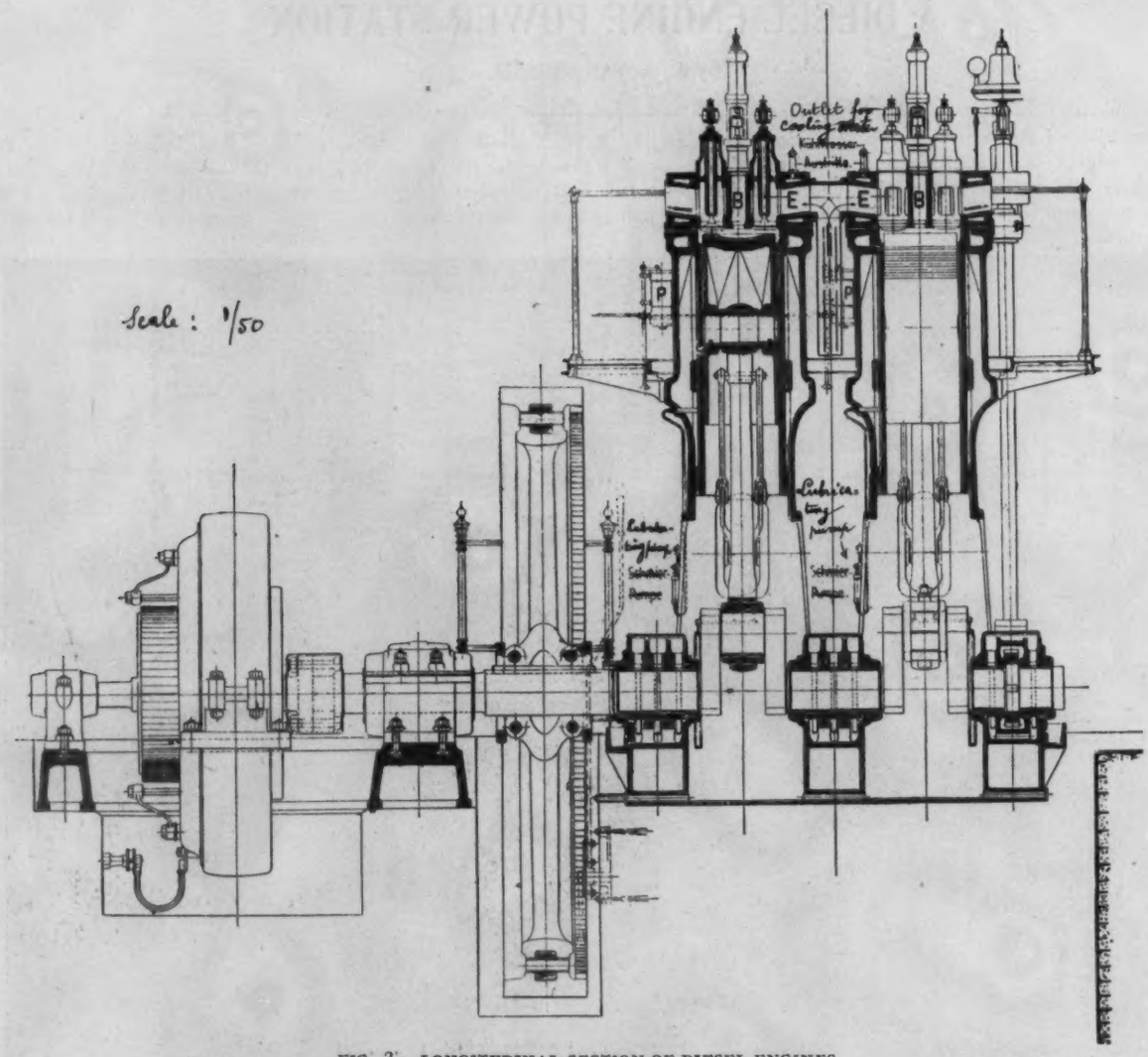


FIG. 2. LONGITUDINAL SECTION OF DIESEL ENGINES

pressure) is then admitted to the cylinder by means of the valve "V," and the engine starts. After two or three revolutions, the engine attains its normal speed, and then the handle "G" is put over to the running position, closing the starting valve "V," and opening the fuel valve "B." Compressed air from the air injection vessel drives the liquid fuel into the cylinder, and the engine begins to work. The compressed air for the starting and air injecting vessel is provided by two-stage air pumps "L," which are attached directly to the engine, and are driven from the connecting-rod through links. Each engine has two of these air pumps. As soon as the air in the starting vessel has a pressure of sixty atmospheres, this vessel is disconnected from the pumps. On the other hand, the air-injection vessel remains connected to the pumps as long as the machine is working, as compressed air is continuously required for injecting the fuel, as explained above. The liquid fuel is delivered to this valve by a special pump "P," driven from the cam-shaft "H." The valves of the pump are acted on by the governor of the engine; so that by varying the duration of the opening of the valves more or less, the amount of fuel fed to the cylinder is regulated. By this method of governing, the closest regulation is attained on varying loads.

Each engine is directly coupled to an eight-pole generator, and each machine generates 300 amperes at 500 volts. The dynamos are connected directly to the outers of a 2x220-volts three-wire network. Carbon brushes are employed; the length of the commutator is seven and one-half inches, and its diameter thirty-nine and one-fourth inches.

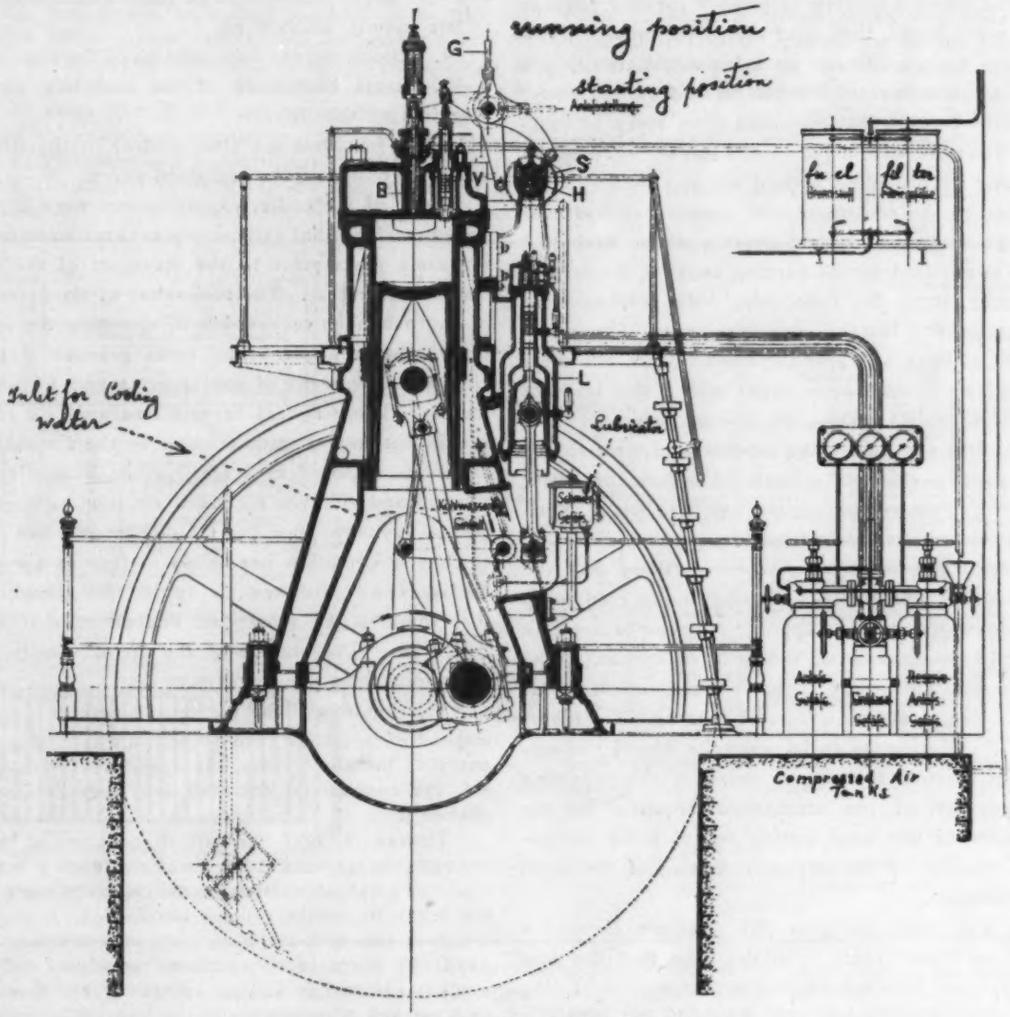


FIG. 3. CROSS-SECTION DIESEL ENGINE

In addition to the engine sets, there is a booster-balancer set in the engine room. Each of the two boosters can deal with 180 amperes, and raise the pressure twenty volts when running at a speed of 670 revolutions per minute, and at 800 revolutions per minute, the pressure can be increased to 132 volts with 120 amperes of current passing normally. The other two machines can be used as a balancer set, but the battery is at present found sufficient for the purpose. These four machines forming the set are all four-pole, but have, in addition, four commutating poles.

The fuel used for the engines is paraffin oil, and after this oil has been consumed in the engine, there is hardly any residue.

Hereafter we give the results of fuel consumption obtained after a five-hour test. It is to point out that the figures of fuel consumption per horse-power show a relatively small increase at the smaller loads, an advantage which it is said no other internal combustion engine possesses in such a degree.

Load	Fuel consumption per horse-power-hour, in grammes.
Full load	175
Three-quarter load	184
Half load	212
One-third load	247

The calorific value of the oil was ascertained to be of 9,900 calories per kilogramme. The consumption of cooling water was also very low, namely, 2.2 gallons per horsepower-hour.

INVENTION OF THE ENCLOSED ARC LAMP.*

By L. B. Marks.

Prior to the year 1894, the only arc lamps that were used in commerce were those of the open arc type. In these lamps the carbons burned about seven hours, after which it was necessary to insert new carbons in the lamp. Most of the arc lamps were used for street lighting. As the life of a pair of carbons was too short for all night burning, it was found necessary to provide for this purpose double carbon arc lamps, that is to say, those in which two sets of carbons were used, one set being automatically put into service at the moment the other set had burned away; thus the time of burning was increased from seven to fourteen hours. Attempts were made to still further increase the time of burning by providing a third set of carbons in the lamp, and later by the construction of magazine lamps containing a large number of carbon pencils, which were successively fed as required by the burning away of the carbon. To secure long life of the lamp, very long carbons were tried in place of the lengths commonly used; the cross-section of the carbons was also increased. With the same object in view the carbons were plated with a thin layer of copper or zinc or both, and the life thereby increased from twenty-five to fifty per cent. The expedient of treating the carbons by soaking them in a bath of boracic or metaphosphoric acid to retard combustion was also tried. Various forms of economizers were tried for conserving the life of the carbons. The most successful of these was the Hardmuth, which consisted of a metallic frame resting on the tip of the negative carbon supporting a tube of fire clay surrounding the lower end of the positive carbon. The action of the economizer was to prevent the inrush of atmospheric air to the carbon ends and thus retard combustion. All of these attempts to increase the life of the carbons failed in practice for one or more of the following causes: complication of the mechanism required for the purpose, liability of the lamp getting out of order, irregularity in the burning of the carbon, screening of the light, expense of renewals.

Although the experiments in this direction covered a period of about fifteen years from the time that the first arc lamps were put into service, the problem of producing a commercial long-burning, open arc lamp had not been satisfactorily solved. Curiously enough, many years before the modern open arc came into industrial use, investigators had studied the question of economizing carbon in arc lamps and had produced experimental lamps designed to run continuously without trimming many times as long as the double carbon open arc lamp already referred to. The method invariably employed was to surround the carbons by a globe closed air-tight or nearly so. In this way the access of the air to the enclosure was diminished or prevented, thereby greatly retarding the consumption of the carbons. Straite produced an experimental lamp of this kind in England in 1846. In 1878 Varley attacked the problem from another direction. He conceived of using carbon powder to feed the arc in place of the carbon pencils hitherto used. Varley employed a stream of finely powdered graphite or carbon, which was constantly renewed as the requirements of the light necessitated. The pulverized carbon was placed in a chamber or reservoir provided at the lower end with a small orifice through which the powder was allowed to flow in a fine stream like sand flowing in an hour glass. This stream of carbon impinged on two conducting poles, between which the arc was produced. The apparatus was enclosed in an air-tight case.

From 1878 to the early 90's, a host of experimenters in different parts of the world attacked the problem of prolonging the life of the carbons by excluding air from the arc. So far as the records go these experiments resulted in failure mainly because of,

1. Flickering and unsteadiness of the light.

2. Rapid blackening of the enclosing globe and obscuration of the light.

Many instances are also cited of the bursting of globes due to explosion of the contained gases.

Some of the earlier experimenters were handicapped by impure carbons, but satisfactory carbons were on the market for some years prior to the invention of the enclosed arc lamp of commerce. The real secret of the invention lay not in improving the carbon, but in operating the arc on an entirely new principle. The usual practice was to operate arcs with a current of ten amperes and forty-five volts at the arc. These figures became standards for the arc. The new invention was made possible by the discovery that when an arc is enclosed in a small globe having a suitably restricted and suitably regulated air inlet, a long arc of abnormal voltage may be steadily maintained by a small current—a condition impossible in free or open arcs. This discovery was followed up by the construction of a lamp that would strike a long arc and maintain it under proper conditions. The voltage of the arc is usually eighty volts and the current five amperes.

The solution of the problem therefore, involved: first, a method of operation, and second, an apparatus for carrying out that method. Once these features were given to the art, the commercial enclosed arc lamp became an accomplished fact.

Though the first commercial arc lamps of this type were put upon the market in 1894, it was not until a few years later that the great advantages of the enclosed arc over the open arc began to receive general recognition. A pair of carbons, which in the open arc lamp burn only seven or eight hours, burn 150 hours in the enclosed arc lamp. The open arc lamp is addicted to hissing, sputtering and flaming, resulting in a marked unsteadiness of the light. The enclosed arc, on the other hand, gives a very steady light. The enclosed arc also gives a better distribution of illumination for most purposes than does the open arc. The candle power of the enclosed arc is considerably less per unit of electrical energy consumed than is the candle power of the open arc, but the saving in the cost of carbons and of trimming, and the other advantages of the enclosed over the open type of carbon arc lamp, far more than compensate however for this difference in candle power. In a city having 5,000 arc lamps for instance, the saving of the enclosed arc over the open arc in cost of carbons and trimming alone will easily amount to $50,000 a year.

The enclosed arc lamp has not only driven the open arc lamp from almost all the electric light circuits of this country, but has enormously extended the field of arc lighting. Between 750,000 and 1,000,000 enclosed arc lamps are now in use in the United States, of which number some 400,000 are used on the circuits of the electric light companies yielding an annual income to these companies estimated at $25,000,000.

*Sibley Journal of Engineering.

CALIBRATIONS OF VARIOUS MINER'S INCH OPENINGS.

Written by Kent A. Hawley.

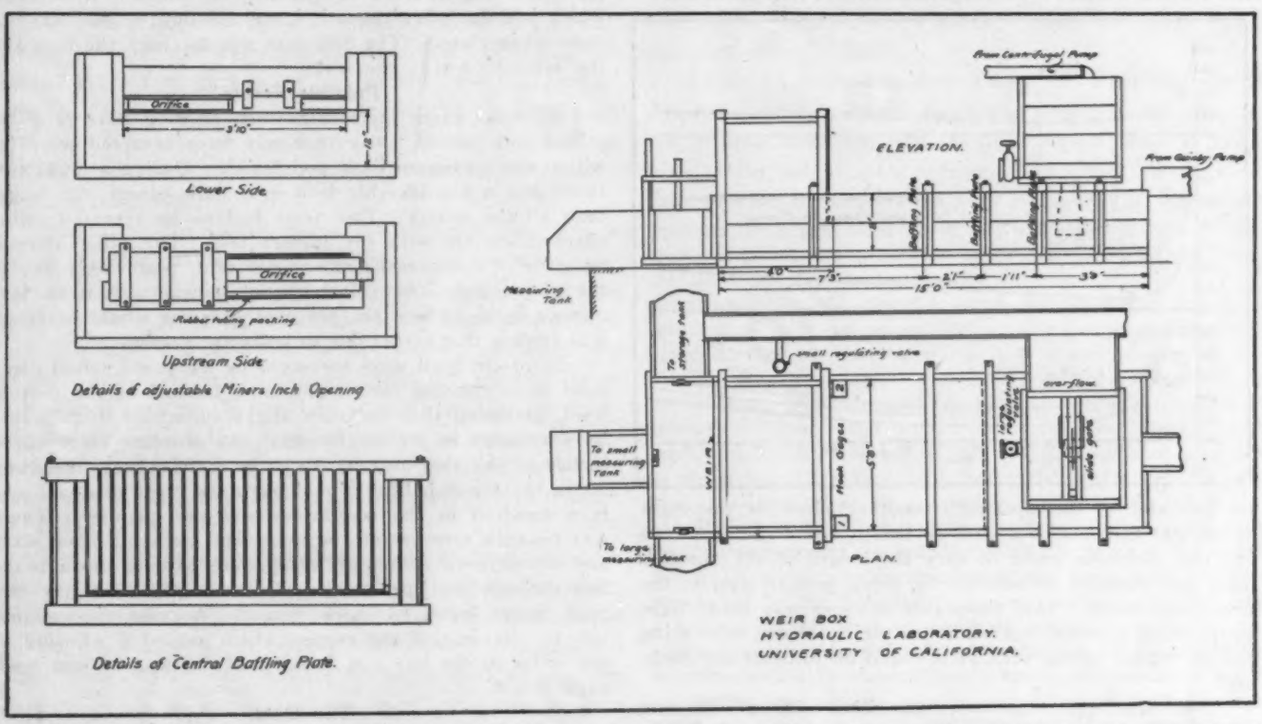
When the miners first came to this State (California) in the middle of the last century, they had to find some means to measure the water that they used in hydraulicing and sluicing for the gold. In general they adopted a method of measurement that had first been used in Italy. As a standard they said that the water that would flow through an opening two inches high and one-half inch wide in a plank one and a-quarter inches thick and under a head of four, five, or six inches, according to the locality, should be known as a "Miner's Inch." They then assumed that the quantity of water flowing through an opening of the same height and thickness was proportional to the length of the opening. The errors and proportional factors in this case have been thoroughly investigated by the "Pelton Water Wheel Company." (See Kent's Hand Book, page 585.)

the opening. From the theory of hydrodynamics it can be shown that the velocity, and consequently the quantity discharged in a given time varies with the square root of the head above the point. Hence it is evident, were it not already proven in practice, that there must be some correcting factor when the formula referred to above is used for the mean velocity of the water through the orifice.

Again, the effects of contraction become less in proportion to the quantity flowing, the longer the opening, when the height of the opening and the mean head are kept constant, so it is necessary to determine this factor for different lengths of opening as well as different heads.

To determine these co-efficients and to find the quantity of water flowing through the different sized orifices is the purpose of this test, hoping that it will lead to some standard means of measuring water where the methods are still in use.

Experiments have been made at McGill University, Montreal, Canada, with orifices under heads from six inches



However, in some localities, particularly in the most southern counties of California, the water companies tried to improve on this method of measuring the water by substituting an opening in metal instead of in the plank, hoping to get more uniform results by doing away with the more or less rough lumber.

In doing this they failed to standardize their systems of measuring water. For instance, we find the companies selling water through openings one, two and even four inches high, assuming that the quantity of water flowing through the opening is proportional to the area of the opening, provided only that the head is the same above the center of the orifice. This would necessarily be correct if the velocity of the water discharging through the opening were equal to the square root of twice the product of the head and the acceleration due to weight and the head above the center of the opening. But this being a formula of pure hydrodynamics, does not hold for two reasons. First, it does not account for the phenomenon known as "Contraction," i. e., the decrease in size or the contraction of the stream due to the rush of the water from the sides. Second, it assumes one of two things either that the velocity of the water at any point in the stream is proportional to its depth, or that the velocity of each and every point is the same throughout the depth of the stream flowing through up to twenty feet. (Proceedings of the Canadian Society of Civil Engineers, Vol. 14, page 130.) No results have been found for heads less than six inches, and these were not sufficient for the six inch head. Four, five, and six inches are the heads most commonly used and are the ones investigated in this test.

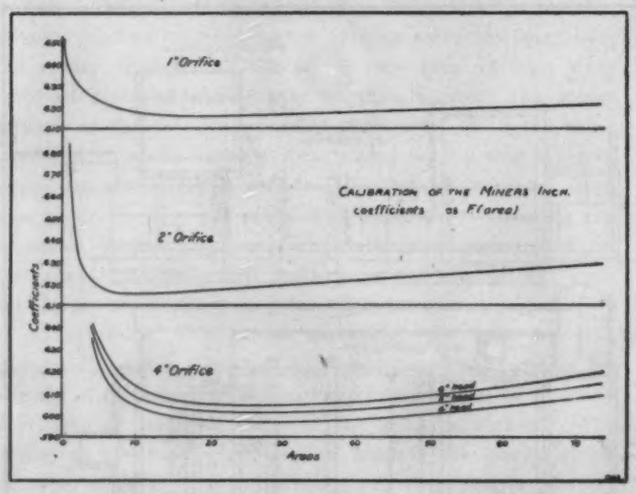
Apparatus.

The water was pumped from a large storage tank by a centrifugal pump capable of throwing about three-quarters of a cubic foot of water per second. The quantity of water delivered into the regulating tank was controlled by a by-pass back into the storage tank. Also, two "Quinby" screw pumps were used in series or parallel according as three-quarters or one and a quarter second feet more were wanted.

The wier box as shown in the figure measured 2x5¾x15 feet. It was made of two-inch lumber on solid foundations on a concrete floor so that there was no sagging when filled with water. It was lined with sheet metal throughout to make it water tight. Seven feet above the wier there was a baffling plate to distribute the flow of the water evenly in all parts of the box. It was a solid board across the box with a space of about two inches between it and the bottom. Two feet above this there was another baffling plate made like a board fence as shown in the figure. Two feet

further up there was a third built like the first but somewhat smaller than the first. Its purpose was chiefly to destroy the surface waves. Thus there was a surface of water above the wier 5¾x7 feet as smooth as possible with water flowing through it.

The wier board or front end of the box was cut away to within eleven inches of the bottom of the box and a foot of the sides to make way for the wier or miner's inch openings. A piece of sheet iron somewhat longer than the above opening was nailed to a board of the same length and was filed so that the edge projecting beyond the board was straight. This was leveled up and nailed on the inside of the front of the box with the metal on the upstream side, so as to make the bottom edge of the miner's inch opening. Similarly a six-inch board with a strip of metal fastened to it was nailed in the inverted position at the proper distance from the lower edge so as to form the upper edge of the miner's inch opening. A piece of metal was fastened permanently between the two strips of metal



on one end of the opening. Another piece of the right width was fastened to a stick so that it could slide between the two strips, in order to vary the length of the opening. This was clamped in position by being pressed against the projecting metal. This adjustable opening was made tight by pressing a board against it on the upstream side, using hollow rubber tubing such as is found on cameras for packing.

Four feet above the wier on either side of the box there was a hook gage, an instrument consisting of a vertical sliding scale with a wire on the lower end bent into a hook and sharpened so that the instant the point pricks the surface from underneath, the distortion of the surface is plainly visible. The hook gage marked "1" in the figure was fitted with an adjusting screw and a vernier reading to .001 of a foot. Hook gage No. 2 had but a vernier.

The level of the lower edge of the opening was obtained as follows: A stand of variable height was placed inside the box and was adjusted by means of an ordinary carpenter's level, so that the highest point was level with the edge of the opening. The box was filled with water, the meniscus at the edge keeping the surface above the point. Then the water was drawn off until the surface was just pricked by the point. The level of the water which was that of the bottom of the orifice was taken by the hook gages. A repetition of this near the end of the test showed that the adjustments had not been changed in any way.

The water from the centrifugal pump was delivered into a large regulating tank resting on top of the wier box. The quantity of water flowing into the wier box was roughly adjusted by a slide gate in the bottom of the regulating tank. A more careful adjustment was then made in each case by a large gate valve which discharged between the second and third baffling plates. The final and most delicate adjustment was made by a two-inch globe valve leading from the side of the wier box into the sewer. In making a test, hook gage No. 2 was set at the desired level and the water was set so that the point was just piercing the surface. At the same time another would take readings by hook gage No. 1 at regular intervals to act as a check and, if necessary, to make corrections for errors in the adjustment of the level of the water should they for any reason be sufficiently large to require corrections.

From the wier box the water emptied into a three way trough, leading to the two measuring tanks and to the storage tank. The measuring tanks were large concrete reservoirs, reinforced with twelve-inch I-beams. The capacity of the small tank was 1.523 cubic feet for each centimeter rise of the hook gage, and of the large tank, 6.6345 cubic feet per centimeter rise.

Each gate in the flume consisted of a drop gate as shown in the figure, and a water tight gate made of a piece of rubber packing with its edges nailed to the sides of the flume and fastened to a board the width of the flume, which laid flat when the water was running by and was upright when closed. The first gate was to check the flow and the second to stop the leaks.

Possible Errors.

All leaks about the miner's inch opening were carefully calked and puttied. Any that may have occurred were far within the maximum limit permissible. During a night test there was a considerable leak in a dark corner, far larger than all the others. Two tests had to be repeated. One checked exactly with the former test. The other showed an error of three-tenths of one per cent, presumably due to the above leak. As this occurred during a test on four miner's inches where the per cent of error would be large, it is evident that errors due to leaks are negligible.

Errors in head were corrected by using the actual mean head in calculating the co-efficients, instead of the desired head, assuming that for such slight variations there would be no change in the co-efficients. An absolute error of .08 inches in the four-inch head, .10 in the five-inch head, and .12 in the six-inch head would cause an error of about one in a hundred in the co-efficient and the quantity. There was no such error at any time, except, perhaps, when sixty and seventy-two inches of water were passing through the box through the opening four inches high. Then the two hook gages failed to check properly, because the opening was to one side of the center, which caused a whirling of the water in the box and banking of the water about hook gage No. 2.

The Data.

In the tables of data and calculations, the first column gives the approximate dimensions of the miner's inch opening; the second, its actual area as computed from careful measurements of the orifice; the third, the duration of the tests in minutes; the fourth, the rise of the water in the measuring tank, in centimeters, during the test; the fifth, the height of the surface of the water, in feet, above the center of the opening; the sixth, the calculated co-efficient, c, that when multiplied by the velocity of discharge of the water and the area of the opening, will give the quantity of water flowing through the opening; seventh, the cubic feet that will flow through the full-sized opening in a minute; eighth, the number of gallons that will be discharged per square inch of the orifice. The seventh column is for comparison with the legal miner's inch which has been defined by the State Legislature as the equivalent of one and one-half cubic feet of water per minute. The eighth column is for comparison with the miner's inch which is defined in some contracts in gallons in twenty-four hours.

Conclusions.

As the quantity discharged for any head is proportional to the co-efficient times the area, the relative variation of the quantity per square inch may be obtained by examining the co-efficients.

The results for the small openings are not what are

ordinarily expected. It is the common idea that the "friction" about the sides of the opening causes a large loss with the smaller sizes, but there seems to be an increase in the co-efficient as the area decreases from nine square inches.

From this point there is a gradual increase in the co-efficient as the area increases. The maximum variation for this part of the range is about one per cent for the one-inch orifice, and two per cent for the two and four-inch orifices.

The two-inch orifice seems to give the greatest quantities for the larger areas where it is one per cent greater than the other two.

In general, the four-inch orifice should not be used because of the eddies that form about it when large quantities of water are taken through it. These eddies and the resulting waves at least greatly decrease the accuracy of the measurements.

CARDINAL GIBBONS ON ORGANIZED LABOR.

Labor has its sacred rights, as well as its dignity. Paramount among the rights of the laboring classes is their privilege to organize, or to form themselves into societies for their mutual protection and benefit. It is in accordance with natural right that those who have one common interest should unite together for its promotion, writes Cardinal Gibbons, in the October "Putnam's Monthly."

Throughout the United States and Great Britain there is to-day a continuous network of syndicates and trusts, of companies and partnerships, so that every operation, from the construction of a leviathan steamship to the manufacture of a needle, is controlled by a corporation. When corporations thus combine, it is quite natural that mechanics and laborers should follow their example. It would be as unjust to deny the workingmen the right to band together, because of the abuses incident to such combinations as to withhold the same right from capitalists, because they sometimes unwarrantably seek to crush or absorb weaker rivals.

God forbid that the prerogatives which I am maintaining for the working classes should be construed as implying the slightest invasion of the rights and autonomy of employers. There should not, and need not, be any conflict between capital and labor, since both are necessary for the public good, and the one depends on the co-operation of the other. A contest between the employer and the employed is as unreasonable and as hurtful to the social body as a war between the head and hands would be to the physical body.

Whoever strives to improve the friendly relations between the proprietors and the labor unions, by suggesting the most effectual means of diminishing and even removing the causes of discontent, is a benefactor to the community. With this sole end in view I venture to touch this most delicate subject, and if these lines contribute to some small measure to strengthen the bond of union between the enterprising men of capital and the sons of toil, I shall be amply rewarded.

But if labor organizations have rights to be vindicated and grievances to be redressed, it is manifest that they have also sacred obligations to be fulfilled and dangers to guard against. As these societies are composed of members very formidable in numbers, varied in character, temperament and nationality, they are, in the nature of things, more unwieldy, more difficult to manage, more liable to disintegration than corporations of capitalists, and they have need of leaders possessed of great firmness, tact and superior executive ability, who will honestly aim at consulting the welfare of the society they represent, without infringing on the rights of their employers. They should exercise unceasing vigilance in securing their body from the control of designing demagogues, who would make it subservient to their own selfish ends, or convert it into a political engine.

We must guard against any word or act that is contrary to the law. Every American citizen has the right to be protected in his efforts to earn an honest livelihood. No man or combination of men should have the power to prevent him from following his vocation, even by intimidation, for he may have not only himself, but a wife and children, for whom to provide. It is my opinion that the honest laborer who is willing to do work which is proper and in no way conflicts with the interests of the community, should be given the opportunity to perform it, and to have the same protection from the authorities which is extended to any peaceful citizen, no matter how powerful or influential may be the person or society which opposes him.

I take for granted that all unions and other societies of American laboring men are disposed to array themselves on the side of peace and order, and are as strongly opposed to violations of the law as other citizens. Hence they should exert their influence to see that the laws are upheld, if they would maintain the respect with which they are regarded by their fellows. It is not only a question of patriotism, but of self-interest, which deeply concerns them.

I am persuaded that the system of boycottting by which members of labor unions are instructed not to patronize certain obnoxious business houses, is not only disapproved by an impartial public sentiment, but that it does not commend itself to the more thoughtful and conservative portion of the guilds themselves. Every man is free, indeed, to select the establishment with which he wishes to deal, and in purchasing from one in preference to another he is not violating justice. But the case is altered when by a mandate of the society he is debarred from buying from a particular firm. Such a prohibition assails the liberty of the purchaser, and the rights of the seller, and is an unwarrantable invasion of the commercial privilege guaranteed by the Government to business concerns. If such a social ostracism were generally in vogue, a process of retaliation would naturally follow, the current of mercantile intercourse would be checked, every center of population would be divided into hostile camps, and the good footing which ought to prevail in every community would be seriously impaired. "Live and let live" is a wise maxim, dictated alike by the law of trade and by Christian charity.

Experience has shown that strikes are a drastic, and at best a very questionable remedy for the redress of the laborers' grievances. They paralyze industry, they often foment fierce passions, and lead to a destruction of property; and above all they result in inflicting grievous injury on the laborer himself by keeping him in enforced idleness, during which time his mind is clouded by discontent while brooding over his situation, and his family not infrequently suffer from the want of the necessaries of life. The loss inflicted by strikes on the employers, is not much more than half as great as that which is sustained by the employed, who can much less afford to bear it. It would be a vast stride in the interests of peace, and of the laboring classes, if the policy of arbitration which is now gaining favor for the settlement of international quarrels, were also availed of for the adjustment of disputes between capital and labor. Many blessings would result from the adoption of this method; for, while strikes, as the name implies, are aggressive and destructive, arbitration is conciliatory and constructive. The result in the former case is determined by the weight of the purse, in the latter by the weight of the argument.

THE INCANDESCENT ELECTRIC LAMP AND ITS MANUFACTURE.*

By Foster Hannaford.

After the discovery of the electric arc in 1800, many experiments were made with the purpose of dividing or subduing its intense light, and thus making it a practical means for indoor lighting. From these experiments was evolved the incandescent electric lamp.

The principle of the incandescent lamp is to replace the air gap in the arc light by a thin conductor and to heat this conductor to incandescence by passing the electric current through it. This principle is still adhered to in all incandescent lamps, but it was a long time before lamps made along these lines could be called a success, because of the fact that the temperature to which the thin conductors or filaments had to be heated, in order to give useful results, was so near their melting point that a slight increase in current destroyed the lamp.

In 1878 great improvement was made by using a fine platinum wire for the filament. Owing to the extremely high melting point of platinum, these filaments were capable of withstanding a considerable excess of current, but were not a commercial success. An American named J. W. Starr substituted a carbon filament for the platinum one, but his lamp also failed. This was due largely to the fact that at that time the cost of generating the necessary current was very great. In 1879, as a result of innumerable experiments, Thomas A. Edison improved Starr's carbon filament and produced the first successful electric lamp.

The incandescent lamp of to-day is nearly identical with the Edison lamp of 1879. It is in such general use that to describe its appearance is unnecessary, for it would be hard to find a person who has never seen it. On the other hand, the number of people who have seen electric lamps made is very limited, so it will be the purpose of this paper to tell of some of the processes of manufacture.

The ordinary lamp has four parts—the bulb, the budge, the base, and the filament.

As the bulbs are blown in a glass factory, the first process that concerns the lamp factory is preparing them for the vacuum pumps. With a needle-like flame from a blowpipe a small hole is melted at the spot where the familiar glass tip is to be seen on the finished lamp. Into this hole is fused a piece of glass tubing about two inches long, and into the tubing is injected a chemical the nature of which seems to be somewhat of a trade secret. Some of this chemical adheres to the tube, and its use will be described later in speaking of the vacuum process.

The budge is the glass stand which is put in the neck of the bulb and to which the filament is fastened. The glass tubing from which the budge is made is first cut into proper lengths and then thrown into the feeder of a machine. This machine automatically heats the ends of each piece in a blowpipe flame, and then turns a flange on it. The two lead wires and the anchor wire are now run through the tube. The other end is heated and then pressed together. The portion of each lead wire which runs through the glass is made of platinum, thus insuring a joint which will not be affected by change in temperature, since the co-efficient of expansion of platinum and glass is the same.

The bases of different electric lamps vary in shape and arrangement, but are usually made to fit some standard socket.

The filament is by far the most important part of the lamp, for its shape and its arrangement in the bulb determine the diffusion of the light, and its quality determines the life of the lamp. In the great majority of lamps the filament is carbon in one form or another. Surgeon's cotton is the material used to make the carbon. The cotton dissolves, in a solution containing zinc oxide, into a gelatinous fluid about the consistency of molasses. This fluid is forced through fine platinum jets into a revolving jar of cold alcohol, and winds itself into a coil of gelatinous fiber greatly resembling catgut. The coil is lifted out of the jar on a wire screen and washed in weak acids and water to remove all the zinc oxide and other substances. The cotton is left in its original composition, but in the form of a fiber. This fiber is wound on large drums, and, when dry, is cut into pieces of the proper lengths for filaments. The pieces are separated into packages of about twenty each, and the packages are wound around moulds of compressed carbon and baked or carbonized in air-tight crucibles.

The shape of the mould, of course, determines the shape which the filament will take in the bulb. Some filaments have one large loop, some two or three small loops, and some are twisted in a sort of double spiral. The more complicated the curve of the filament the more difficult it is to prepare the mould for the baking. In case of the twisted filament the fiber has to be wound around the mould several times and, as it shrinks in the baking, great precaution must be taken to prevent its breaking. The mould is scooped out where the fiber is to be wound and then is filled with paraffine. In the baking the paraffine melts and leaves a space for the fiber to shrink into.

After the filaments have been carbonized they are each separately elaborated to one one-thousandth of an inch and divided according to the power of the lamp in which they are to be used. This test, however, is not sufficient, and after the filaments have been sorted they are placed in a vacuum and a specified current passed through them. Their resistance is measured, and if it is found to be too high a hydro-carbon gas, which deposits carbon on the filaments, is let into the vacuum until the filament has been sufficiently built up and the resistance brought to the desired amount.

The filaments are now ready to be put in the lamps. This is accomplished by pasting the ends of the filaments to the lead wires in the budge and fusing the budge into the neck of the bulb. The lamp is next exhausted. That is, the air is taken out so that when the carbon is heated it will not burn and destroy the lamp.

This process in the last few years has been entirely revolutionized and the old mercury pump has been displaced by suction pumps and chemicals. The suction pumps and chemicals produce a vacuum in the following manner: The bulb is securely connected to the pump by the little piece of glass tubing, which has been mentioned before, and as much air as possible withdrawn. An electric current is now passed through the lamp and the filament heated to incandescence. The chemical in the glass tube is heated, from the outside with a small blowpipe, and the vapor from it, combined with the gases given off from the heated filament, and the remaining air in the bulb forms a solid which condenses in the cool base of the bulb, thus forming an almost perfect vacuum. The glass tube is heated and twisted off, sealing the bulb and forming the little tip on the end. The whole process takes from one to two minutes, while the best of the old mercury pumps required about one hour, for each bulb, to produce the necessary vacuum. The bases are now cemented on to the bulbs and the lamps are complete.

These processes apply to all carbon filamented lamps, but, since at the present time, lamps with tantalum and tungsten filaments have begun to be commercially manufactured in this country, the carbon cannot be considered the only incandescent lamp. It is, however, by far the most common, and until the new incandescent lamps have been thoroughly tried and proved to be better, the carbon filamented lamp will maintain its position as the standard incandescent lamp.

*"Yale Scientific Monthly."

CORRESPONDENCE

Seattle, Wash., Oct. 25, 1907.

The Editor: Sir—I note in your issue of October 19th the surprising statement on page 334 that the first constant current open-coil dynamos were brought out in 1880 by Thompson and Houston. Now, as every one knows, the first constant current open-coil machine was that of C. F. Brush, introduced in 1876 and in very general use by 1879. Mr. Brush always claimed the invention of the open-coil armature and in an article written by him about two years ago said that many imitations followed this successful introduction of his machine, the most successful of which employed the open-coil method of winding.

Yours very truly,

J. A. BOWEN.

[The statement to which reference is made appeared in a paper read at the Fifteenth Annual Convention of the Pacific Coast Gas Association. The correction is received with thanks.—Editor.]

Los Angeles, Cal., Oct. 25, 1907.

The Editor:

Sir:—In your issue of October 12, 1907, you published on page 315, Wrinkle No. 9, entitled "Method of Using Shakes in Scrubbers," over the signature of H. W. Burkhart, for which I have application pending for patents. I immediately called to Mr. Burkhart's attention the facts, and the enclosed letter which he authorized for publication as explanatory is hereto attached. Will you please publish the same, as I have made arrangements with Eastern manufacturers to handle the same, and hereby give notice to anyone who may attempt to use the same without authority.

Yours truly,

JOSEPH M. BERKLEY,

Engineer.

Los Angeles, Cal., Oct. 24, 1907.

Mr. J. M. Berkley,

509 Wilcox Building, City.

My Dear Mr. Berkley: Referring to the misunderstanding which has arisen regarding the shake scrubbers, you will, I am sure, take my word for it that the publication of the item in the Pacific Coast Journal of Electricity and Gas, through the proceedings of the Pacific Coast Gas Association, was simply and purely a desire on my part to present what appeared to me a good wrinkle in the gas business. Coming as I did into the gas department of the Edison Company and discovering it in use, without knowing that any application had been made for a patent covering it, and not having received any instructions whatever, I simply wanted to give my confreres in the gas business the benefit of what I thought was a good stunt. There was no intention whatever on my part to invalidate any claims, neither is there yet any intention to do so, and this letter is written to you so that you and all others interested may understand the situation, and to prevent any legal complications in the issuance of letters patent to you.

Yours truly,

(Signed) H. W. BURKHART.

BELL'S PROPHECY OF TELEPHONE DEVELOPMENT.

The following copy of a letter written by Professor Alexander Graham Bell to the capitalists who promoted the first telephone company in the United States shows the confidence he had at that time regarding the development of the telephone business. This letter is copied from the Michigan State Gazette for September:

"Kensington, March 25, 1878.

"To the Capitalists of the Electric Telephone Company.

"Gentlemen:—It has been suggested that at this, our first meeting, I should lay before you a few ideas concerning the future of the electric telephone, together with any suggestions that occur to me in regard to the best mode of introducing the instrument to the public.

"The telephone may be briefly described as an electrical contrivance for reproducing, in distant places, the tones and articulations of a speaker's voice, so that conversation can be carried on by word of mouth between persons in different rooms, in different streets, or in different towns.

"The great advantage it possesses over every other form of electrical apparatus consists in the fact that it requires no skill to operate the instrument. All other telegraphic machines produce signals which require to be translated by experts, and such instruments are therefore extremely limited in their application, but the telephone actually speaks, and for this reason it can be utilized for nearly every purpose for which speech is employed.

"At the present time we have a perfect network of gas pipes and water pipes throughout our large cities. We have main pipes laid under the streets communicating by side pipes with the various dwellings, enabling the members to draw their supplies of gas and water from a common source.

"In a similar manner it is conceivable that cables of telephone wires could be laid under ground, or suspended overhead, communicating by branch wires with private dwellings, country houses, shops, manufactories, etc., uniting them through the main cable with a central office where the wire could be connected as desired, establishing direct communication between any two places in the city. Such a plan as this, though impracticable at the present time, will, I firmly believe, be the outcome of the introduction of the telephone to the public. Not only so, but I believe in the future wires will unite the head offices of telephone companies in different cities, and a man in one part of the country may communicate by word of mouth with another in a distant place.

"In regard to other present uses for the telephone, the instrument can be supplied so cheaply as to compete on favorable terms with speaking tubes, bells and annunciators, as a means of communication between different parts of the house. This seems to be a very favorable application of the telephone, not only on account of the large number of telephones that would be wanted, but because it would lead eventually to the plan of intercommunication referred to above. I would, therefore, recommend that special arrangements be made for the introduction of the telephone into hotels and private buildings in place of the speaking tubes and annunciators at present employed. Telephones sold for this purpose could be stamped or numbered in such a way as to distinguish them from those employed for business purposes, and an agreement could be signed by the purchaser that the telephones should become forfeited to the company if used for other purposes than those specified in the agreement.

"It is probable that such a use of the telephone would speedily become popular and that as the public became accustomed to the telephone in their houses they would recognize the advantage of a system of intercommunication.

"In conclusion, I would say that it seems to me that the telephone should immediately be brought prominently before the public as a means of communication between bankers, merchants, manufacturers, wholesale and retail dealers, dock companies, water companies, police offices, fire stations, newspaper offices, hospitals and public buildings and for use in railway offices, in mines and other operations.

"Although there is a great field for the telephone in the immediate present, I believe there is still greater in the future.

"By bearing in mind the great object to be ultimately achieved, I believe that the telephone company can not only secure for itself a business of the most remunerative kind, but also benefit the public in a way that has never been previously attempted.

"I am, gentlemen, your obedient servant,

"ALEXANDER GRAHAM BELL"

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Entry changed to "The Journal of Electricity," September, 1895.

VOL. XIX NOVEMBER 2, 1907 No. 18

EDITORIAL.

FINANCE AND MANUFACTURING.

Among the many startling announcements of interest to the financial, industrial and engineering world which came from the East, and especially from New York, during the week of October 21st to 26th, none perhaps caused greater surprise than the statement that the Westinghouse Company of Pittsburg had been placed in the hands of receivers.

All over the country, as well as on the Pacific Coast, the Westinghouse Company has been known as one of the largest and most progressive electrical manufacturing companies in the world, and it seemed hardly possible with the present industrial activity that this company could have serious financial difficulties.

As a matter of fact, from the industrial and engineering situation, the appointment of receivers to carry on the business of any such corporation means very little. The financial situation in which the allied Westinghouse companies find themselves today is entirely separate and distinct from the manufacturing side of their business. Not in the history of the company has there ever been a time that their order books were so filled with profitable business as during the past eighteen months. Not only this, but steadily has the company grown during the past seven years. The following table gives accurately the orders taken by the company for the fiscal years 1901—1906-07 inclusive.

April 1, 1900, to March 31, 1901.....	$12,516,071.86
April 1, 1901, to March 31, 1902.....	17,927,339.43
April 1, 1902, to March 31, 1903.....	19,571,294.91
April 1, 1903, to March 31, 1904.....	18,569,614.21
April 1, 1904, to March 31, 1905.....	16,570,717.13
April 1, 1905, to March 31, 1906.....	24,939,602.35
April 1, 1906, to March 31, 1907.....	34,175,548.00

In fact, it is perhaps due to the enormous business of the company that they find themselves today temporarily in financial trouble. In the endeavor to protect the many interests commonly going under the name "Westinghouse," the Security Investment Company, of Pittsburg, was organized, which in the financial world is simply a holding company, which acted for the Westinghouse interests in the capacity of a bank, thereby drawing together the different subsidiary companies more closely. The Security Investment Company financed many electric power, light and railway companies which used equipments furnished by the Westinghouse interests. When the money stringency came, it was impossible for the Security Investment Company to realize upon its securities, with the result that the stock of the Westinghouse Electric and Manufacturing Company principally was jeopardized, in as much as it had been used as collateral by the Investment Company to secure large loans. When the financial flurry of last week in New York City was at its height, it was found expedient for the Pittsburg Stock Exchange to suspend, which action naturally prevented the unloading upon the market of millions of dollars of securities, among which stock of the Westinghouse Company was the greater part. The suspension of the Stock Exchange, therefore, prevented the loss of millions, but nevertheless it was necessary to appoint receivers for the Westinghouse companies, and in every State of the Union the same receivers who have been appointed to take charge of the factory at Pittsburg have been selected to look after the interests of the company in its different local districts.

The progress which has been consistently the policy of the Westinghouse Company will not be modified as a result of the appointment of receivers. Development work of every character will be maintained as it has been in the past, this work of the company being amongst the most important which is carried on at the factory. The single phase railway system has for years occupied a most important place in this experimental development. Advances have also been made by the company in the design and construction of generators for direct connection to steam turbines. A number of machines of 7,500 kilowatt capacity have been built, and are now in operation, and there are now being constructed several turbine generators having a capacity of 10,000 kilowatts.

The Westinghouse Lamp Company has been engaged in the development of the new form of incandescent lamp commonly known as the "Metalized Filament Lamp," which marks a very decided step in advance in electrical illuminants of the vacuum type.

It is impossible to enumerate in detail the manifold activities of the Westinghouse Company, and it is

worthy of note that neither will the turning out of standard apparatus, the construction of new factory buildings, or experimental and development work, be interfered with as a result of the present, and is to be hoped temporary, financial difficulties of the company.

There are at the present time twenty-three district and fourteen subsidiary offices at which the company maintains resident representatives. The sales department numbers five hundred and eighty-three employes, there having been an increase during the past year of one hundred and fifty-four employes.

Coupled with the enormous engineering and commercial progress of the company, the cost of manufacture and selling the product of the company has been less during the past year than at any time during the history of the corporation. The business involving the industrial application of electricity has, during the past few years, shown a remarkable expansion, and there can be no question that except for the temporary slowing up due to the money stringency there will be even greater developments in the utilization of electrical appliances within the next few years than ever before.

It should be well understood by everyone that the difficulties, about which we have been hearing so much during the past week, in the East, have little or no influence in the manufacture, sale, and use of manufactured products. The mass of the people over the entire country are but little affected, and after all, it is perhaps fortunate that so excellent an example as the Westinghouse Company is available to show the small influence which the financial stringency has over the construction and sale of manufactured appliances.

THE INDIVIDUAL AND THE BANKS.

Five months ago we made some strenuous remarks regarding the individual who thinks it proper to withdraw his savings from the bank and hoards it either in his cellar or in a safe deposit vault. Since that time the wisdom of our contention has been the more fully demonstrated. Not only can no good result from such action on the part of individuals, but very great harm comes not only to himself but to everyone else. To the individual who is so inclined we beg to suggest that he get together all of his miserable, financial and material wealth, and forthwith seek someone who can give him security such as real estate, government bonds, farm lands, bank stock, or other proper collateral, see to it that the security is from ten to twenty times the value of his money, and make a loan, getting as nearly "Shylock" interest as possible, and that in advance. In this manner his money will be safe, and yet in the hands of someone who will use it rightly.

The timid safe deposit crank, whether rich or poor, is more to be feared at the present time than anyone else, not excepting the rabid labor union agitator, the boodler, or the trust magnate.

PERSONAL.

C. A. Poe is in charge of the newly-established office of the Northern Electrical Mfg. Co., of Madison, Wis., at 618 Park Bldg., Pittsburg, Pa.

A. C. Thode & Company, electrical contractors, have been awarded the contract for the electric installation of the bottling building belonging to the San Francisco Breweries Company, Ltd., located at Second and Folsom Streets.

Charles W. Burkett, for four years chief engineer of the Wisconsin Telephone Company, and one of the foremost men in his line in this country, will resign soon to accept a similar position with the Pacific States Telephone & Telegraph Company, with headquarters in San Francisco. He will enter upon the discharge of his duties there between November 1st and January 1st.

TRADE CATALOGUES.

Bulletin No. 106 from the Barriett Electric Mfg. Co., of Cincinnati, Ohio, portrays Polyphase Induction Motors for ½ to 50 horsepower for two or three-phase circuits at all standard voltages.

The Welsbach Company sends an attractive booklet describing the history and processes by which a Welsbach mantle is made. Bulletin No. 11 illustrates and describes incandescent gas lighting exhibits at Jamestown.

Victor Combination Meters for direct current are attractively described in a handsomely illustrated catalogue, No. 404, from H. W. Johns-Manville Co. The meter is made on the d'Arsonval Galvanometer principle and has been especially designed to economize switchboard and bench space and gives a simultaneous reading of volts, amperes, watts and horsepower on one dial.

A booklet which should prove useful to everyone who sells electric motors or motor-driven machinery to the Navy Department has been issued by the Cutler-Hammer Manufacturing Company, of Milwaukee, makers of electric controlling devices. This company for many years has made a special study of Navy Department requirements, and in the booklet issued full descriptions, illustrations, dimension diagrams and shipping weights are given on starting panels, speed regulating panels, machine tool controllers, resistances, circuit breaker panels, etc. In the preface to the booklet in question attention is called to the fact that navy specifications preclude in nearly all instances the use of ordinary controlling panels, and, furthermore, that apparatus acceptable for use in navy yards will not always be acceptable if supplied for use on shipboard. How to select the proper piece of apparatus in each case is fully explained, and in addition to numerous illustrations of electric controlling appliances conforming to Bureau of Construction and Repair and Bureau of Equipment Specifications, the booklet includes several views of battleships equipped with Cutler-Hammer control.

The American Society of Mechanical Engineers will hold its next regular monthly meeting on Tuesday evening, November 12, at 8:15 o'clock, in the building of the Engineering Societies, 29 West Thirty-ninth Street, New York. The principal address will be made by Mr. Charles R. Pratt and will treat of features of construction and operation of the Gearless Traction Electric Elevator, which is being installed in the Singer and Metropolitan Life, New York's two highest buildings. The paper will be discussed by engineers and architects from New York, Philadelphia and Chicago. It is expected that the subject will be very exhaustively treated from the view of the architect and the engineer. The members of all professions are cordially invited to attend.

LOCAL STOCKS AND BONDS

Furnished by Courtesy San Francisco Stock and Bond Exchange.

Outstanding	INTEREST	MISCELLANEOUS BONDS.	OCT. 24		OCT. 25		OCT. 26		OCT. 28		OCT. 29		OCT. 30	
			Bid	Asked	Bid	Asked	Bid	Asked	Bid	Asked	Bid	Asked	Bid	Asked
1,532,000	F & A	Associated Oil Co. 5%	75	.....	75	.....	75	.....	75	....	75	.....	75	.....
2,250,000	M & S	Bay Counties Power Co. 5%	92½	.....	92½	.....	92½	.....	92½	.....	92½	.....	92½	.....
1,000,000	F & A	Cal. Central Gas & El. 5%	.....	100	.....	100	.....	100	.....	100	.....	100	.....	100
9,600,000	M & S	Cal. Gas & El. Gen. M. & C. T. 5%	.....	70	.....	.....	.....	.....	.....	.....	.....	.....	.....	70
900,000	J & J	California St. Cable Co. 5%	.....	102½	.....	102½	.....	102½	.....	102½	.....	102½	.....	102½
2,000,000	J & J	Contra Costa Water Co. 5%	.....	100¾	.....	100¾	.....	100½	.....	100½	.....	100½	.....	100
1,000,000	J & J	do do Gen. Mtg. 5%	.....	91	.....	90	.....	90	.....	90	.....	90	.....	90
623,000	F M A N	Edison Light & Power 6%	109	.....	109	.....	109	.. ..	109	.. ..	109	.....	109	.....
650,000	M & S	Ferries & Cliff Ho. Ry. 6%	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
671,000	A & O	Geary St. Ry. 5%	50	80	50	80	50	80	50	80	50	80	50	80
610,000	M & N	Honolulu R. T. & L. Co. 6%	.....	108	.....	108	.....	108	.....	108	.....	108	.....	108
300,000	A & O	Lake Tahoe Ry. & T. Co. 5%	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
500,000	J & J	Los Angeles Elec. Co. 5%	.....	100	.....	100	.....	100	.....	100	.....	100	.....	100
1,300,000	J & J	Los Angeles Gas & Elec. Co. 5%	.....	100	.....	100	.....	100	.....	100	.....	100	.....	100
5,000,000	A & O	Los Angeles Ry. 5%	.....	107¾	.....	107⅛	.....	107½	.....	107½	.....	107¾	.....	107½
1,000,000	A & O	Los Angeles Lighting Gd. 5%	.....	102	.....	101½	.....	102	.....	102	.....	102	.....	102
1,500,000	A & O	Los Angeles Pac. R. R., 1st Con. Mtg. 5%	.....	101	.....	101	.....	101	.....	101	.....	101	.....	101
3,030,000	M & S	L. A. Pac. R. R. of Cal. 5%	.....	100	.....	100	.....	100	.....	100	.....	100	.....	98
3,000,000	J & J	Market Street Cab'e 6%	.....	106	.....	106	.....	106	.....	106	.....	106	.....	106
5,141,000	M & S	do Ry., 1st Cons. Mtg. 5%	.....	102	.....	102	.....	102	.....	102	.....	102	.....	102
100,000	A & O	Mill Valley & Mt Tamalpais S.Ry.5%	100	.....	100	.....	100	.....	100	.....	100	.....	100	.....
4,751,000	A & O	Northern Ry. Co. of (Cal.) 5%	.....	110½	.....	110¾	.....	110¾	.....	.....	.....	110½	.....	110½
1,498,000	J & J	North Pacific Coast R. R. 5%	.....	102	.....	102	.....	101½	.....	101½	.....	101½	99¾	.....
1,074,000	J & D	Northern Cal. Railway 5%	105	.....	105	.....	105	.....	105	.....	105	.....	105	.....
980,000	J & D	Northern Cal. Power Co. 5%	.....	100	.....	100	.....	100	.....	100	.....	100	.....	100
6,000,000	A & O	Northern Electric Co. 5%	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	99
1,000,000	M & S	Oakland Gas Light and H. 5%	101½	105	101½	105	101½	105	101½	105	101½	105	101½	105
1,374,000	J & J	Oakland Transit Co. 6%	108½	109¾	108½	110	108¾	110	108¾	110	108¾	110	108¾	110
1,600,000	J & J	Oakland Transit 5%	101½	.....	101½	.....	101½	.....	101½	.....	101½	.....	101½	.....
1,326,000	J & J	Oakland Transit Con. 5%	.....	102	.....	101	.....	101	.....	101	.....	101	..	101
7,000,000	J & J	Oakland Traction Con. 5%	.....	99	.....	98	.....	98	.....	98	.....	98	.....	98
1,500,000	J & J	Oakland Water Co. gtd. 5%	.....	95	.....	95	.....	95	.....	95	.....	95	.....	95
2,000,000	A & O	Omnibus Cable Ry. 6%	.....	111	.....	111	.....	111	.....	111	.....	111	.....	111
1,149,000	S D M J	Pacific Gas Imp. 4%	.....	95	.....	95	.....	95	.....	95	.....	95	.....	95
8,494,000	J & J	Pacific Electric Ry. Co. 5%	100	101	.....	101½	.....	101½	.....	101½	.....	101½	.....	101½
4,491,000	J & J	Pacific Light & Power Co. 5%	.....	97½	.....	97½	.....	97½	.....	97½	.....	97½	.....	97½
3,000,000	J & J	Pacific Tel. & Tel. Co. 5%	.....	102½	.....	102½	.....	102½	.....	102½	.....	102½	.....	102½
350,000	J & J	Park & Cliff House Ry. 6%	.....	104	.....	104	.....	104	.....	104	.....	104	.....	104
250,000	J & J	Park & Ocean R. R. 6%	.....	104	.....	104	.....	104	.....	104	.....	104	.....	104
700,000	M & S	Powell Street Railway 6%	.....	106½	.....	106½	.....	106½	.....	106½	.....	106½	.....	106½
2,500,000	M & N	Sacramento Elec. Gas & Ry. 5%	.....	97½	.....	100	93	96	94	.....	.....	95½	94⅜	95
6,000,000	A & O	S. P. & S. J. Valley Ry. 5%	.....	110	.....	110¾	.....	109½	.....	109½	.....	109½	.....	110¾
3,000,000	J & J	S. P., Oak. & San Jose Ry. 5%	.....	103½	.....	103½	.....	103½	.....	103½	.....	103½	.....	103½
1,500,000	J & J	do do 2d Mtg. 5%	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
1,500,000	A & O	S. J. & S. Clara Co. R. R. 4½%	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
642,000	A & O	Sierra Ry. of Cal. 6%	102	.....	102	.....	102	.....	102	.....	102	.....	102	.....
6,000,000	J & J	S. P. R. R. of Arizona 6% (1909)	.....	101½	.....	101¾	100½	101¾	.....	101¾	.....	101¾	100¾	.....
4,000,000	J & J	do do do (1910)	.....	102½	.....	102½	101¾	.....	100	102	.....	101½	101¾	101½
5,116,000	A & O	S. P. R. R. of Cal. 6% (1912)	.....	.....	102	.....	102	105½	101½	.....	102	.....	102	.....
4,127,500	M & N	S. P. R. R. of. Cal., 1st c. gtd. 5%	112½	.....	112½	.. ..	112½	.....	112½	.....	112½	.....	112½	.....
3,533,000	A & O	S. P. Branch Ry. of Cal., 6%	.....	.....	.....	.....	.....	.....	.....	.....	.....	122	.....	122
81,178,000	J & J	S. P. R. R. Co., 1st Ref'd'g. 4%	88½	.....	83	.....	84	.....	84	.....	84	.....	84	.....
17,500,000	J & D	Spring Valley Water Co. Gen. Mtg. 4%	.....	86½	85	86½	85	86½	85	86½	.....	86½	.....	87
300,000	M & S	Stockton Gas & Elec. Co. 6%	.....	105	.....	105	.....	105	.....	105	.....	105	.....	105
2,000,000	J & J	United Gas & Elec. Co. 5%	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
20,000,000	A & O	United R. R. of S. F. 4%	64	65½	63½	64½	63	64½	63¾	64½	63½	64	62½	.....
2,500,000	M & N	Valleys Counties Power Co. 5%	.....	95	.....	95	.....	95	.....	95	.....	95	.....	95
		Water Stocks.												
.....	.....	Contra Costa	.....	62	.....	62	.....	62	.....	62	.....	62	.....	62
6,000	Quarterly	Marin County	45	.....	45	.....	45	.....	45	.....	45	.....	45	.....
280,000	....	Spring Valley Water Co	19¾	.....	19½	20	.....	20	.....	20	19	20	.....	20
		Gas and Electric Stocks.												
37,500	....	Martel Power Co	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
9,340	....	Mutual Electric Light Co. (Ctfs.)	4⅝	.....	4⅝	.....	4⅝	.....	4⅝	.....	4⅝	4¾	4⅝	4¾
37,336	....	do (Extended Ctfs.)	9⅛	9⅜	9⅛	9⅜	9⅛	9⅜	9⅛	9⅜	9⅛	.....	9⅛	9⅜
40,000	Monthly	Pacific Lighting Co	65	.....	65	.....	65	.....	65	.....	65	.....	65	.....
12,000	....	Stockton Gas & Elec. Co	52	.....	52	.....	52	.....	52	.....	52	.....	52	.....
		Street Railroad Stocks.												
10,000	.. ..	California	.....	135	.....	135	.....	135	.....	135	.....	135	.....	135
10,000	....	Geary	.....	35	.....	35	.....	35	.....	35	.....	35	.....	35
10,000	....	Presidio	.....	25	.....	25	.....	25	.....	25	.....	25	.....	25
	Semi-an.	Associated Oil Co	.....	28	.....	28	.....	.....	23	27½	.....	27½	24	26½
1,625	Quarterly	Mill Valley & Mt. Tamalpais S. Ry.	110	.....	110	.....	110	.....	110	.....	110	.....	110	.....
180,000	Quarterly	Pac. Tel. & Tel. Co. (Pfd.)	.....	80	.....	80	.....	80	.....	80	.....	79	.....	.....
180,000	....	Pac. Tel. & Tel. Co. (Common)	10	11	10	.....	10	.....	10	10½	10	11	10	11

Unlisted Securities

750,000	A & O	Bay Counties Power Co. 6%	97	.....	97	.....	97	....	97	.....	97	.....	97	.....
745,000	M & S	Blue Lakes Water Co. 6%	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
2,000,000	A & O	California Northwestern Ry. 5%	.....	106	.....	106	.....	106	.....	106	.....	106	.....	106
160,000	J A J O	Marin County Water 5%	.....	100	.....	100	.....	100	.....	100	.....	100	.....	100
600,000	J & J	Risdon Iron Works 5%	.....	100	.....	100	.....	100	.....	100	.....	100	.....	100
500,000	M & S	S. F. Dry Dock 5%	100	109	100	109	100	109	100	109	100	109	100	109
8,000,000	M & N	S. P. Gas & Electric 4½%	.....	95	.....	95	.....	95	.....	95	.....	95	..	95
3,926,000	J & J	S. P. & North Pacific Ry. 5%	.....	108	100	104	100	102½	100	102½	100	102½	100	102½
5,500,000	J & J	South Pacific Coast Ry. 4%	.....	90	.....	90	.....	90	.....	90	.....	90	.....	90
.....	....	Standard Electric Co. 5%	.....	80	.....	80	.....	82½	.....	82½	.....	82½	.....	85
.....	.....	do do Gtd. 5%	.....	85	.....	85	.....	85	.....	85	.....	85	.....	85
750,000	J & J	Sunset Tel. & Tel. Co. 6%	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
2,250,000	A & O	Sunset Tel. & Tel. Co. 5%	.....	103½	.....	103½	.....	103½	.....	103½	.....	103½	.....	103½
1,000,000	M & N	Sutter Street Railway 5%	.....	103	.....	103	.....	103	.....	103	.....	103	.....	103
		Stocks.												
50,000	Monthly	Gas Consumers' Association	.....	18	.....	18	.....	18	.....	18	.....	18	.....	17½
100,000	Monthly	Northern Cal. Power Co	20	23	20	23	20	23	.....	22	.....	22	.....	22
.....	....	Pac. Gas & Elec. (Pfd.)	.....	45	.....	45	.....	45	.....	45	.....	45	.....	.....
.....	....	Santa Cruz Port. Cement	.....	47½	.....	47½	.....	47½	.....	47½	.....	47½	.....	47½
.....	....	Standard Port. Cement (New)	.....	50	.....	50	.....	50	.....	50	.....	50	.....	50
50,000	Monthly	Truckee Electric Co	13½	.....	13½	.....	13½	.....	13½	.....	13½	.....	13½	.....

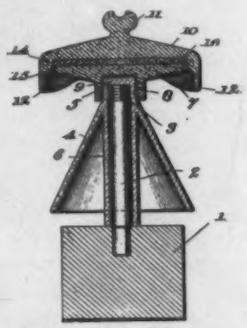
PATENTS

Electric, Gas and Water.

Specially reported for the Journal of Electricity, Power and Gas.

ELECTRIC INSULATOR. 868,122. Francis J. Poinan, Rochester, N. Y.

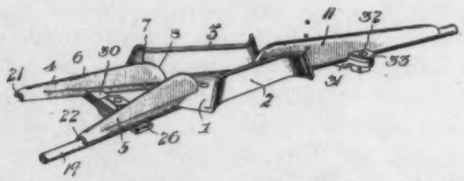
In an insulator, the combination of a support, a pin thereon, and an insulating portion having a lower section comprising a flaring glass petticoat having an internal



longitudinal sleeve formed integral therewith within which sleeve pin fits, glass portion entirely surrounding pin except where it fits into support, and an upper composite insulating section of different material from lower section.

LINE-WIRE SWITCH-FROG FOR ELECTRIC RAILWAYS. 867,939. Harry J. Beck, Winburne, Pa.

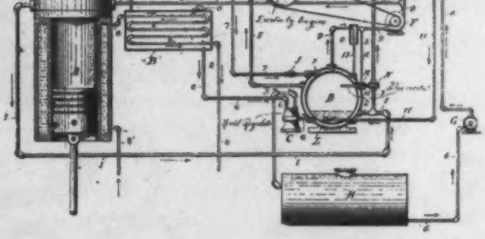
In a switch-frog the combination with its body part and a plurality of splice-pieces, one of which is movable



and provided with a pivotal connection with the body part, of means of line-wire connection with splice-pieces including line-wire engaging means upon movable piece, at its point of pivotal connection.

GENERATING OIL-GAS FOR EXPLOSIVE ENGINES. 868,246. Frank H. Bates, Ross Station, Cal.

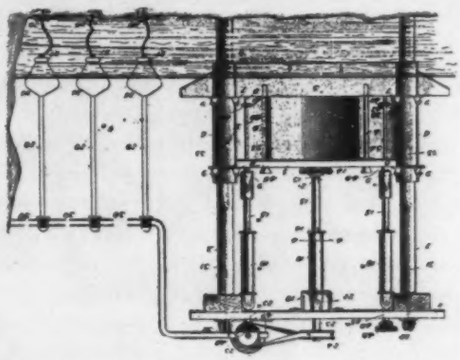
In an apparatus for generating oil-gas for explosive engines, an explosive-engine generator system, including a



gas generator and a gas engine, in combination with means for preheating the liquid hydro-carbon delivered to the generator, by a heating medium expended from system, means for pre-heating the air, by a heating medium expended from system, means for delivering pre-heated hydrocarbon and pre-heated air separately to the generator, means for withdrawing the gas and air from the generator at a constant rate comprising a blower driven at a speed regardless of the engine load, and means for delivering them to the engine at a constant pressure, comprising a pressure regulator disposed between the blower and the engine.

WATER-CURRENT MOTOR. 867,459. Charles H. Willard, Pasadena, Cal.

In a water current motor, the combination with a waterwheel, of a casing therefor, an inlet opening for directing the water into the casing, a pair of swinging gates for di-



recting the water to the opening when they are open and adapted to close together in angular arrangement to each other when closed, chains connected to the gates, and means for simultaneously operating the chains to simultaneously open or close the gates.

WATER GOVERNOR. 864,990. Walter J. Richards and Charles P. Tolman, Milwaukee, Wis.

The combination of a compression cylinder surrounded by a water jacket, an electric motor for reciprocating a piston within cylinder, an electric circuit for motor, a supply pipe leading to water jacket, a valve chamber interposed in the path of supply pipe, a valve in chamber for normally closing passage through supply pipe, a stem extending from valve, a bushing through which valve stem extends, a collar on valve stem, a spring interposed between collar and valve seat to normally hold valve in a closed position, a solenoid core, a solenoid winding for core connected in the motor circuit in series with the motor, a piece of non-magnetic material secured to core and engaging valve stem, energization of solenoid causing attraction of core towards valve stem to cause the valve to be opened to admit passage of water through water jacket, solenoid being energized and de-energized upon closure and opening of the motor circuit.

STARTER FOR EXPLOSIVE-ENGINES. 864,766. John B. Bartholomew, Peoria, Ill., assignor to the Bartholomew Company, Peoria, Ill.

In a starting device for an internal combustion engine, the combination with the engine shaft and a fly wheel thereon, formed with a concave friction surface, of an arm free to turn about the axis of the shaft, a lever pivoted to the outer end of the arm, a friction shoe carried by the lever and arranged to engage with the friction surface of the fly wheel, and operating means for reciprocating the friction shoe, such means being connected with the pivoted lever at a point between its pivot and the axis of the fly wheel, whereby the shoe is brought into engagement with the fly wheel or is disengaged therefrom in advance by a forward or backward movement of the arm.

INDUSTRIAL

A UNIQUE ELECTRIC GENERATING PLANT.

A novel portable dynamo house with direct-connected electric generating set, has been designed for operation with either gasoline, gas, oil, or alcohol. The outfit is constructed to carry 10, 20 or 30 lights, according to the candlepower and voltage. When operating at a speed of 850 revolutions per minute, the engine develops 1½ horsepower, and the dynamo supplies a current of 104 volts pressure. The electrical generator has a capacity of 7.5 amperes normal load, and will carry a maximum load considerably above this amount.

The electric generating equipment is arranged to operate with illuminating gas or natural gas, and also has the carburetter arranged to use alcohol or gasoline as a fuel, as well as oil, the heated air entering the carburetter from an open "T" at the ends, this fitting being slid over the exhaust pipe, and the air entering the "T" being warmed before reaching the carburetter, by coming in contact with the exhaust pipe, thereby more easily vaporizing the alcohol or oil fuel.

For constant load with a definite number of lights, no regulator is necessary, the outfit running with practically constant speed, an extra flywheel and a flexible coupling taking up the impulses of the engine very satisfactorily. For a variable load, the portable house is provided on the right-hand side with 50 cells of storage battery of 8 or 10 ampere-hour capacity, this being sufficient to give good regulation and supply a reserve current for night lamps in homes; or for extra current during heavy load, taking up current when the motor-dynamo set is operating at less than full load. The voltage is held practically constant by the battery floating on the line, 26 cells only being necessary when 52-volt lamps are used and the engine and dynamo set is run at a correspondingly lower speed and having, of course, at this lower speed, a correspondingly lower kilowatt capacity.

For boat lighting this set is unique and satisfactory, as well as for charging automobile batteries; a double-cylinder engine of larger capacity with a larger generator in this case being desirable. For store lighting, where a constant number of lights are required continuously, a very satisfactory result is obtained without a governor of any kind; but for a variable load, the storage-battery plant is necessary to take up the inequalities, due to the increased speed when lamps are turned off. With the battery in parallel with the engine-generator set and lighting circuit, the load and speed are held constant on the gasoline motor, even though the number of lights are varied.

The portable house is necessary where the fire underwriters object to gasoline being used as a fuel in buildings insured, but where gas is employed a plant of this character can readily be employed in a basement of any kind. Similar outfits are in extended use in Germany and England, and without doubt will be largely used in this country. The foreign engine-dynamo sets are, however, far more costly and are all equipped with governors, cast-iron bases common to both engine and dynamo, while the outfit illustrated has a heavy wooden base. Where a greater output is necessary, two 1½-horsepower cylinders are mounted together, giving a total of three horsepower, with a very even turning moment, there being two explosions for each revolution of the dynamo. In this case twenty 16-candlepower lamps may be operated, or even more, according to how closely the engine is muffled. At the above output, the muffler entirely deadens the explosions, as in the most quiet-running automobiles.

For larger kilowatt capacity for charging electric automobiles and similar service, two 3-horsepower cylinders are used with a generator of 2½ kilowatts capable of operating over 40 incandescent lamps. These outfits are designed for portable or stationary service, and are supplied by the Buffalo Mechanical & Electrical Laboratory, Erie County Bank Bldg., Buffalo, N. Y., U. S. A.

The rapidity with which the steam turbine has come into popular favor is one of the phenomena of modern steam engineering. It is less than a decade ago since the first turbine was sold in the American market, but there are to-day about 700 in use throughout the country, aggregating a total capacity of approximately 1,000,000 kilowatts, or about 1,500,000 horse-power. This wonderful demand for that novel prime mover is, of course, easily explained by the many advantages the turbine has over the reciprocating steam engine. An interesting test was conducted recently by the engineers of the New York Edison Company at the Waterside Station, near Thirtieth Street, which developed facts hitherto unattained by any steam prime mover in this country. The unit under test was a Westinghouse turbine of 10,000 horse-power capacity. It had been sold under a steam consumption guarantee of 15.9 pounds of steam per kilowatt hour, but the test recorded the phenomenally low steam consumption of a shade less than 14.9 pounds per kilowatt hour. Apart from the fact that this result gained a bonus for the Westinghouse turbine of over $25,000, it is of the utmost interest to all users of steam engines as an illustration of the lowest record for steam consumption which has ever been recorded by a stationary steam engine. This steam consumption figures less than one and one-half pounds of coal per kilowatt hour, and graphically illustrates the great advance in modern power plant practice attained through the introduction of the steam turbine; efficiency of which has been demonstrated in all respects to be superior to the reciprocating engines as to practically supplant them altogether.

ALLIS-CHALMERS COMPANY STEAM TURBINES AND GENERATORS IN THE TEXTILE INDUSTRY.

Among the noteworthy features of the textile industry, this fall, has been the ordering of steam turbines, of the improved type built by Allis-Chalmers Company, for installation in some of the largest mills of New England and the Central and Southern States. Power machinery of that company's build has long been prominent throughout the country in manufacturing plants of every description; and, in the electrification of textile mills, Allis-Chalmers steam turbines and generators, as well as its "induction" motors for alternating current, are now playing a leading part. Contracts recently awarded by textile manufacturers include three turbines for the new 10,000 horse-power plant of the Pacific Mills, Lawrence, Mass., one of 2200 horse-power for the American Thread Company's Watuppa Mills, one of 3000 horsepower for the Tremont & Suffolk Mills, and machines of 800 horse-power each for the Jamestown Worsted Mills and Cherry Cotton Mills.

These turbines are of the same general type as the machines installed on the now record-breaking liners "Luisitania" and "Mauritania."

The export business of the Westinghouse Electric & Manufacturing Company has been unusually flourishing of late, and among the contracts taken by the company two from the republic of Colombia, South America, are of more than ordinary interest. This work calls for the complete equipment of two city electric lighting plants. One is for the city of Tunja and the other for Bucaramanja. Tunja is located 9000 feet above the level of the sea in the Colombia Mountains, while Bucaramanja is located two thousand feet lower down the slope. The electric plant for the former will be steam driven, but at Bucaramanja is a splendid water power and the plant will be operated in that manner. A peculiar feature of this mountainous country is that the mule back is the only method of transportation, and all the apparatus, boilers, steam engines, electric generators, switchboard appliances, etc., will have to be hauled from the seaport up into the mountains on mule back.

BOOKS RECEIVED.

The latest addition to the International Library of Technology—a series of text-books for persons engaged in the engineering professions and trades, or for those who desire information regarding them—is a newly-revised volume on Telephony. This comprises one of the five books in the course on telegraphy and telephony given by the International Correspondence Schools. This course has again been completely revised, and brought up to date.

This book clearly explains the fundamentals of the telephone and the properties of telephone circuits, giving a good understanding of the operation of any telephone device or system. The latest types of receivers, transmitters, bells, magneto-generators, hook switches, and complete telephone instruments are detailed. The wiring of buildings and the installation of telephones is thoroughly treated, while disturbances to line circuits and their elimination, the location and construction of transpositions, and large and small magneto switch boards are fully explained. Long-distance telephony and Professor Pippin's methods of applying loading coils to line circuits, are logically discussed.

To a graduate of an engineering college the elementary data on electric circuits seems to enter into too much detail for a book of reference, but it is this very minuteness of exposition that probably gives the text its value as a self-instructor. A fine index enables the consulting student to find what he wishes to know. This, as well as the other volumes and courses on electrical work, can be obtained from C. A. Conry, 2182 Mission Street, San Francisco.

THE WESTINGHOUSE RECEIVERSHIP.

It is announced from the home office of the Westinghouse Electric and Manufacturing Company, in Pittsburg, that the appointment of receivers for the company will in no way affect the manufacture of the well known Westinghouse apparatus. No changes whatsoever will be made in the various agencies of the company in all of the large cities of the United States, and there will be no reduction of expenses or number of salesmen, engineers, or other employes. The company is prepared, as it has been for years, to fill orders, and under the same conditions existing previous to the establishment of the receivership.

As far as California is concerned, the U. S. Court has appointed the same receivers as were appointed in the East, namely, T. H. Gibbon, H. S. A. Stewart, and E. M. Herr, to have charge of all of the property of the Westinghouse Electric and Manufacturing Co., located in the State of California.

Mr. W. W. Briggs has been appointed manager for the receivers, and Mr. A. M. Irwin has been appointed cashier for the receivers for the San Francisco office and the territory covered by this office. Both Mr. Briggs and Mr. Irwin have, for a long time, been employed in the same capacity for the Westinghouse Electric and Manufacturing Co., and will continue as heretofore to exercise the same duties for the receivers that they have formerly done for the company.

The appointment of receivers is in reality a purely technical financial matter, and will have little or no effect upon the San Francisco office or any of the branch offices of the company or the factory at Pittsburg.

The undersigned desire to assure the clients of The Westinghouse Machine Company and all others interested, that there should be no occasion for apprehension because of the company's application for a receivership.

This action was deliberately and thoughtfully taken as a sensible and logical measure for conserving the interests of the customers, creditors and stockholders of a solvent institution which is doing a large and profitable trade.

From such examination of its affairs as the receivers have been able to make in the short time during which they have been in charge of the property, it would appear that The Westinghouse Machine Company has been suffering from nothing more serious than a rapidly growing and profitable business. This has necessitated the employment of considerable borrowed capital and credit throughout the country, the sudden withdrawal of which would have seriously interfered with the manufacturing operations of the company.

There has not been even a momentary pause in the operations of the company, and the personnel remains the same as heretofore. There will be no departure from the general policy that has hitherto obtained in the conduct of the business, and the receivers will, during their incumbency, spare no pains to foster and maintain the cordial relations that have always existed between The Westinghouse Machine Company and its customers.

WM. McCONWAY,
W. H. DONNER,
E. E. KELLER,
Receivers.

NEWS NOTES

TELEPHONES.

Langley, Wash.—The directors of the Whidby Telephone Company met at the office of the secretary, H. M. McLeod, and voted to extend the line to Coupeville, also an extra wire to Clinton.

Centralia, Wash.—The Northwestern Long Distance Telephone Company was authorized to proceed with the work of installing the fire alarm system, for which their franchise provides, without cost to the city.

Boise, Idaho.—F. E. Leonard, superintendent of construction for the Rocky Mountain Bell Telephone Company, is here from Salt Lake and will remain several days arranging for extension work on the Boise system and also for installing more cable and taking down poles and wires.

Vancouver, Wash.—The City Council granted a franchise to the Home Telephone Company. From the first four councilmen were strongly in favor of permitting the new company to enter Vancouver, E. H. Schofield being the only dissenting member. Schofield argued at length, but finally gave in when he saw it was useless to stand against a petition of nearly 500 residents, who asked that the franchise be granted.

South Bend, Wash.—A telephone line will be run by the government from the North Cove life-saving station to connect with the one at Westport. The superintendent is here to look after the construction. The money has been appropriated, but it will have to be used before June 30th next, or forfeited. The superintendent has tried for a year to get telephone poles at a price which the government considered reasonable.

Walkerville, Mont.—Representatives of the Independent Telephone Company appeared before the City Council and asked for a franchise to do business in the city, and the matter was laid over for another week. The company already has its poles in place throughout the town and some phones in working order. However, the matter of a franchise has never been before the Council and it is now being formally considered.

Helena, Mont.—General Manager Murray, of the Rocky Mountain Bell Telephone Company, declares that the federal injunction granted by Judge Hunt gives the company ample protection from boycotting and interference, and he gave the unions a chance to settle matters peacefully, but since they would not, the company proposes to go ahead with the operation of the plant. A limited local service has been in continuous operation for some weeks.

Seattle, Wash.—The electric company that manufactures the apparatus used by the Bell telephone companies will henceforth sell telephones and supplies to all buyers. This will enable the users of farmers' lines, for instance, to use standard instruments, and thus perfect traffic connections with the Bell telephone lines wherever it is desirable to do so. The Bell telephone companies have not heretofore favored any connection with farmers' lines because they are usually inferior in construction and in equipment. This is, therefore, a complete change of policy—the most important since the organization of the Rocky Mountain Bell Company some thirty years ago.

ELECTRIC RAILWAYS.

Spokane.—The Spokane & Inland Empire Railroad Company's first annual report shows that the Spokane & Inland division began operation of thirty-four miles September 24, 1906. This mileage was increased 11 8-10 miles February 1, 1907; April 5, increased 24 8-10 miles; June 1, increased 47 6-10 miles, and the Coeur d'Alene & Spokane division, July 19, 1907, began operation of an extension to Hayden Lake, Idaho, 8 2-10 miles. The company operated 123½ miles, aside from its street-car lines in Spokane. The report shows that on account of construction 330 shares preferred and 165 shares of common stock were issued to Sanderson & Porter as part payment of fee as designing and constructing engineers on electric power plant; to Westinghouse Electric & Manufacturing Company, 1000 shares preferred and 500 common as payment on contract for machinery and supplies; to J. P. Graves, F. Lewis Clark and F. A. Blackwell, 2000 shares common in lieu of salary during construction period.

A summary of the expenses of the entire line shows $29,461 for maintenance of way and structures, $19,959 for maintenance of equipment, $176,100 for conducting transportation, and $34,083 for general expenses, which aggregate 54.22 per cent of the earnings of the entire line.

The road carried a total of 672,412 passengers, receiving a revenue of $274,781, or a little more than 40½ cents per passenger, or about 18½ mills per passenger mile. It carried 194,583 tons of freight, receiving $144,252, an average of about 72.6 cents a ton, or less than 2½ cents a ton mile. The income of operation of a mile of road was $1774.

The company added seven locomotives during the year and now has 12 in service; added 22 cars to the passenger service, making 50 in use; added 74 box cars and 40 flats to the freight department, making 318 in freight service, and uses in company work one caboose it owns, one officer car, 19 gravel cars and 19 cabooses owned by other roads. The total number of cars owned by the company is 395. It has used 2002 3-10 tons of bituminous coal in its freight locomotives, an average of 85 pounds a mile run, and paid an average of $6 a ton for the fuel. It reports four employees killed and ten injured, four passengers injured, two other persons killed and three injured during the year. An interesting feature is the statement covering the physical characteristics of the portion of the road in Washington. This shows that on 102 miles there is an aggregate of 280 curves, 50 ascending and 36 descending grades, and about 66 miles of absolutely straight track and 21 miles of level track.

POWER AND LIGHT.

Coulee City, Wash.—J. H. Cunningham is putting in an electric light plant, and expects to furnish light for the town. It is about ready to turn on.

Bellingham, Wash.—Claiming the water that flows from Lake Whatcom, S. B. Hill, of Seattle, has filed a declaration with the county auditor to that effect. He lays claim to all the water that flows from the lake through Whatcom Creek, excepting the riparian rights of Bellingham.

Bremerton, Wash.—Blue prints have been received of the revised drawings for the central power plant at the Navy Yard, showing the general floor plans and the structural steel arrangement, and bids for the steel work will soon be advertised for. The concrete foundation will be put in by the yard force.

Portland, Ore.—The Portland Shipbuilding Co., of St. John, has sold its site in lower St. John to W. B. Streeter for $7,000. It is intended as the site for the proposed gas plant for the St. John Gas Heating & Lighting Co. An option has been taken, and work will soon start on the erection of the plant. The cost will be $35,000, exclusive of mains.

Billings, Mont.—At the meeting of the City Council an application was made by John D. Losekamp for a gas franchise which will permit him the right to construct and operate a gas plant in the city for the purpose of furnishing either manufactured or natural gas. Mr. Losekamp is heavily interested in oil and gas property in the vicinity of Garland, Wyoming.

Buckley, Wash.—The Buckley Electric Company is preparing for the installation of a large dynamo and engine to supply electrical current for the lighting of Buckley. The concrete foundations are being completed, and in a few days the new machinery will be set in place and ready for action. This will place the company in position to handle easily the increased load that will come with the shorter days.

Cottonwood, Ida.—The Cottonwood Water and Light Company, limited, has asked the village council for a franchise to allow the privilege of installing a water system. The Board of Trustees will act on the matter in a few days, as soon as legal requirements can be complied with. It is the intention of the company to install a gravity system, and later on may operate an electric lighting system in connection with the water works.

Centralia, Wash.—A gas franchise was granted to B. H. Petiey for twenty-five years to supply gas for heating and light purposes to the citizens of Centralia. According to the franchise the price the company can charge is limited. For the first five years not more than $2 per thousand feet; $1.50 for the next five years, and $1.25 for the balance of the life of the franchise. At the expiration of the franchise the city reserves the right to purchase the holdings of the company.

Coeur d'Alene, Ida.—The new dredge which P. W. Johnson has been constructing will be completed within a few days. While there are hundreds of dredges in the country, Mr. Johnson claims this is the only one to be operated by electricity, all the others having steam power. It is claimed it will do not only more but better work on this account. The machinery is modern in every respect, and is causing considerable interest among machinists in and about Coeur d'Alene.

Ritzville, Wash.—A surveying crew under Chief Engineer J. W. Macrum is working out of Sprague on the Washington Water Power electric line from Spokane to the different towns in the Big Bend, having mills owned by the Centennial Milling Co., and having contracts with the power company for electric power. The crew here is working from Harrington, strictly on the pole line, which is to furnish power for the different mill and electric plants which the company has under contract.

Seattle, Wash.—Captain E. E. Caine and John C. Eaton have been in Washington in conference with the interior department and the forest service officials relative to the acquisition of a site for a power plant on Rocky Creek, a tributary to the Skagit River, in connection with the plant of the Superior Cement Company. The land on which the site is located is included in the Washington forest reserve, and an application for a permit to put in a power dam will be submitted later. It will take several months to get the application through the various departments, and details will be looked after by a local attorney.

Tacoma, Wash.—A project has been launched the past week by the Cascade Public Service Corporation, which will result in the erection on the Nisqually River at La Grande, of one of the largest electric power plants in Pierce County. The Cascade Public Service Corporation represents the Pacific Traction Co.'s interests, and was formed for the purpose of erecting a power plant for the Pacific Traction Company's lines. Since the cars of the company have been in operation, the power for them has been furnished by the Snoqualmie company, but so rapid has been the growth that the projected plant is an urgent necessity, and plans for it were made long ago.

Stevensville, Mont.—That Stevensville is to have the advantage of an electric lighting system is now practically assured. H. C. Hodge, of Tacoma, is the promoter of the enterprise, and he intends to light both Stevensville and Victor from the same plant. He expects to use as power for the system the water in the Big Creek Canyon, west of Victor, and will use it above where the ditches are taken from the stream for agricultural purposes. He expects to have the plant in operation by the first of the year. At a meeting of the Town Council that body ordered a special election for the freeholders of the town to vote upon the proposition. The result of the election will probably be unanimous in favor of the enterprise, as no one has expressed opposition.

Eugene, Ore.—C. P. Houston, of the Pacific Light and Power Co., of Junction City, which a year or two ago filed upon a water power site on Triangle Lake, which is on the Lake Creek road to the Siuslaw, and about thirty miles west of Eugene, was in the city from Junction, and filed with the County Clerk supplementary papers of appropriation of the waters of the lake. This company has already done considerable development work on the power site and has just let the contract to Drugg & Blachley, of Goldson, to furnish 100,000 feet of lumber with which to build the flume. As much work as possible will be done on the flume this winter, and in the spring it will be completed and development work will be commenced on a larger scale. It is the intention to put in a large electric power plant next summer, and extend the wires to Eugene, Corvallis and Junction City. The company already has a contract to furnish power, for the Excelsior and other plants at Junction City will be removed to Eugene when the power line is completed.

TRANSPORTATION.

Hanford.—F. S. Granger of Denver has been granted an electric railway franchise by the Town Trustees.

Richmond.—Resolutions granting a street railway franchise, as advertised to W. S. Rheem, have been adopted.

Ventura.—The Board of Supervisors has offered for sale the franchise desired by the promoters of the proposed electric railway to the Ojai Valley and the Matillija.

Los Angeles.—A street railway franchise has been granted to F. W. Flint, Jr., for a third rail for the Los Angeles-Pacific and Hill and West Sixteenth Streets lines.

San Diego.—A building permit has been issued and work started on a $25,000 addition to the power plant of the San Diego Electric Railway to allow the company to increase its trailer capacity.

Long Beach.—The City Council has adopted a resolution offering for sale a franchise to traverse the town from one end to the other over Seventh Street. The Pacific Electric make the request for the franchise and also for one over Pine Avenue from Sixth to Fourteenth. The officials state the Seventh Street line will be built shortly.

Sacramento.—Owing to an increase of business, the Northern Electric Railway has been compelled to augment its service between this city and northern valley points. Three new cars from the Chico shops have been put on the run, and all trains will be of two or more cars. Ten new cars from the Niles, Ohio, shops are due to arrive soon, for the Sacramento run. The passenger department of the Northern Electric announces that the Sunday excursions from Sacramento to Chico are drawing crowds, and traffic is handled with great difficulty, making it necessary that more trains and cars be put on in the future.

San Francisco.—Mayor Taylor has affixed his signature to the ordinance passed by the Board of Supervisors granting a franchise to the Parkside Transit Company for an electric street railway in the Parkside and Sunset districts. The board of directors of the company adopted a resolution empowering its president, J. E. Green, to sign the stipulations whereby the company agrees to build a portion of the system in Twentieth Avenue instead of Nineteenth Avenue, as required by the original terms of the franchise, and also to permit the city to acquire the system by purchase during the last ten years of the twenty-five year franchise.

Oakland.—At a recent meeting of the City Council, notice was received of the withdrawal by the Southern Pacific Company of its application for permission to change the Webster Street line into Oakland from steam to electricity. The Councilmen were unable to offer a definite explanation. The Webster Street line is now operated as a part of the Alameda Mole system. The Southern Pacific recently made application in Alameda for franchises to convert its entire Alameda local service into an electric system. The Webster Street branch into Oakland forms a part of that system. The move in Oakland has raised the question as to whether or not the railroad intends to abandon the proposed changes in Alameda.

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